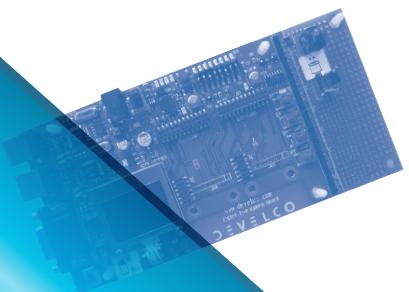


A step ahead

User Manual for ZigBee Development Board



User Manual for ZigBee Development Board

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1 DevKit: Contents of Package

- 1 Development Board
- 1 DevCom 01 ZigBee Module
- 1 DevCom 02 ZigBee Module
- Power supply
- 2 USB cables
- Battery
- CD containing drivers, DevCom Cable Replacement Software and manual

2 Cautionary Notes

- 1) Electrostatic Discharge (ESD) prevention measures should be applied whenever handling this product. ESD damage is not a warranty-repair item.
- 2) Develco A/S reserves the right to make changes to any product to improve reliability without further notice. Develco A/S does not assume any liability arising out of the application or use of any product or circuit described herein; neither does it convey any license under patent rights or the rights of third parties.
- 3) EMC Information on the ZigBee Development Board:
 - A. This product is designed and intended for use as a development platform for hardware or software in an educational or professional laboratory.
 - B. In a domestic environment this product may cause radio interference, in which case the user may be required to take adequate prevention measures.
 - C. Attaching additional wiring to this product, or modifying the product's operation from the factory default as shipped may effect its performance and also cause interference with other apparatus in its immediate vicinity. If such interference is detected, suitable mitigating measures should be taken.

3 Terminology

This development board applies option selection jumpers. The terminology for application of option jumpers is as follows:

Jumper on, in, or installed = jumper is a plastic shunt that fits across two pins, and the shunt is installed so that the two pins are connected with the shunt.

Jumper off, out, or idle = jumper or shunt is installed so that only one pin holds the shunt, no two pins are connected, or the jumper has been removed. It is recommended that the jumpers be idled by installing on one pin so they will not be lost.

4 Features

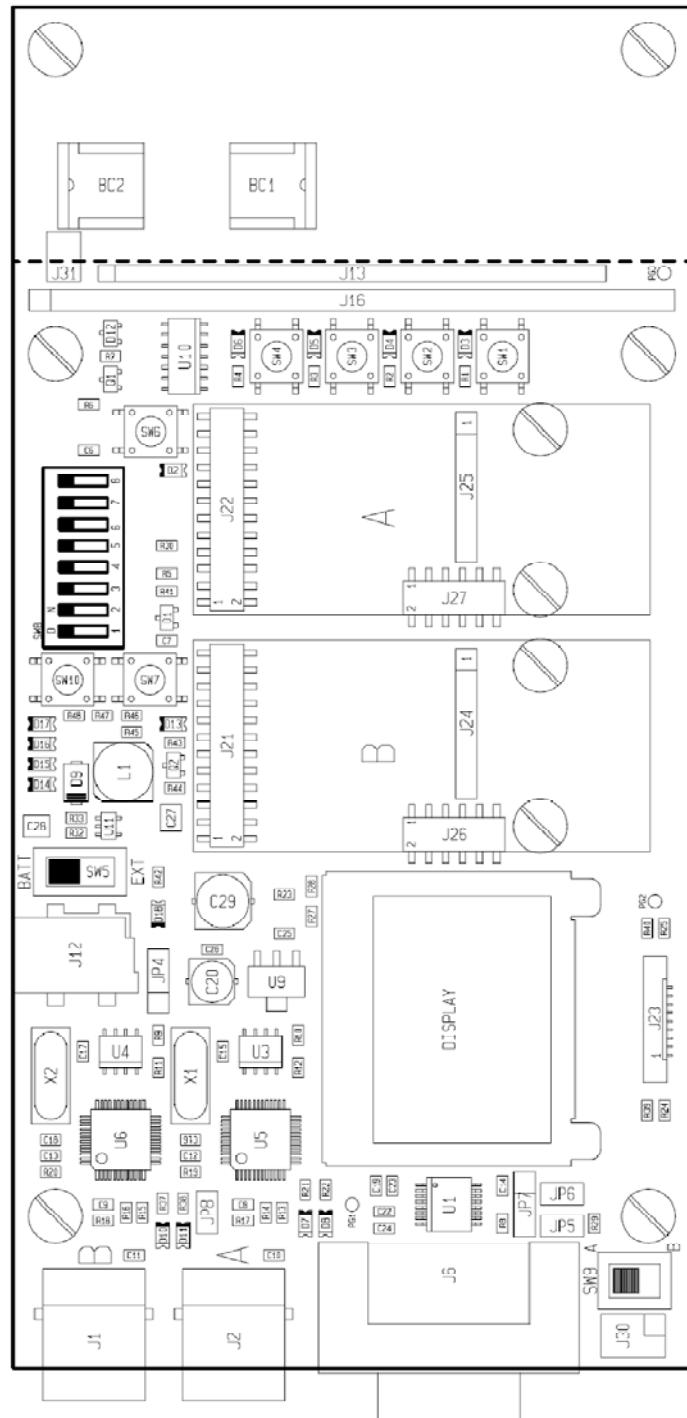
The ZigBee Development Board has been developed to meet the standards of the DevCom module, and all connectors and main functions on the board are based on the DevCom. It is possible to use other ZigBee modules on the development board.

Features:

- 2 dual USB interfaces
 - 2 EEPROM (optional)
 - RX/TX indicators
- RS232 interface
- Power supply via
 - Power jack
 - USB
 - 3V lithium battery, type CR2
- Regulated 3V0 or 3V3 for logic
- Regulated 12V for OLED
- 5 Push buttons
- 5 LED indicators
- 2 Separate reset buttons
- 2 Reset LED indicators
- OLED graphic display
 - 96x64 pixels
 - SPI I/F
 - Monochrome 4 bit
- 30 x 80mm prototype area
 - 2mm spacing
 - 2.54mm spacing
- 1 BDM connector

Specifications:

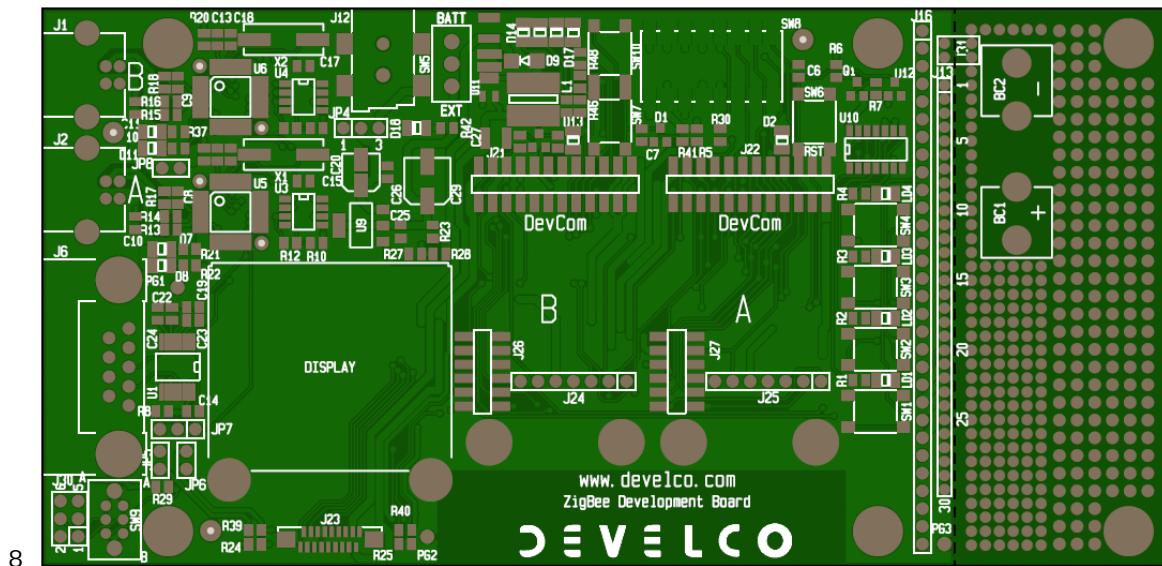
Dimensions: 80x161mm
Power supply: 5-12VDC or 3VDC



5 Getting Started

The ZigBee Development Board is a fully assembled, fully functional development board for the DevCom module. It is provided with the option of wall plug power supply, USB power or battery power and serial communication either via RS232 or USB. Support software for this development board is provided for Windows 95/98/NT/2000/XP operating systems.

The purpose of the development board is to provide the user with an evaluation platform for ZigBee modules, such as the DevCom module.



ZigBee Development Board



ZigBee Development Board

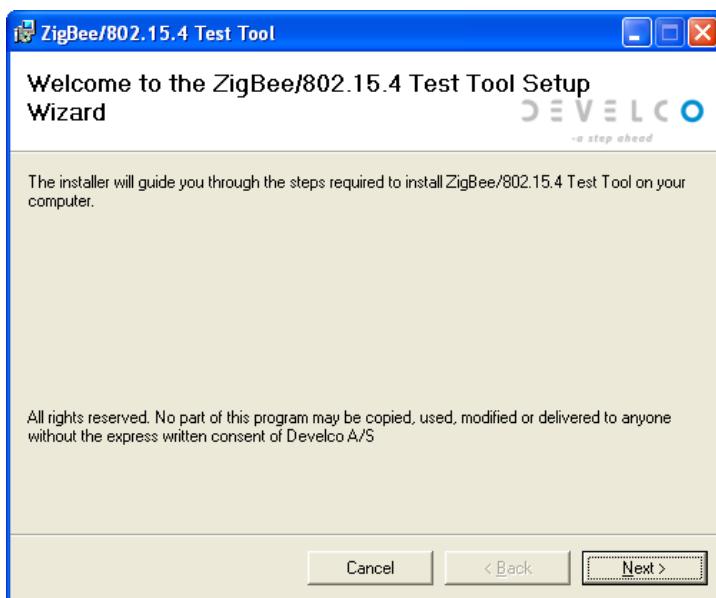
6 Functional Description

6.1 ZigBee/802.15.4. Test Tool

To start the ZigBee/802.15.4. Test Tool, first install the USB driver from the CD. The most recent drivers may be downloaded from www.ftdichip.com.

Next plug the two USB cables included into to the computer. The two ports are to be connected with position A and B on the Development Board (the two DevCom ZigBee Modules). Then connect the ZigBee Development Board.

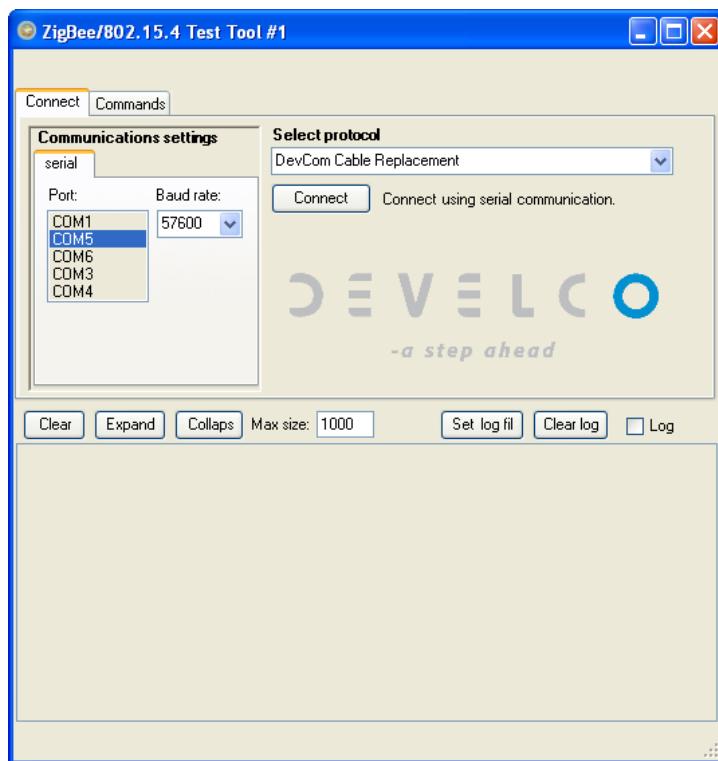
Once the necessary drivers have been installed and the ZigBee Development Board connected to the computer, you can start installing the ZigBee/802.15.4 Test Tool. Click the ZigBee/802.15.4 Test Tool link and follow the instructions in ZigBee/802.15.4 Test Tool Setup Wizard.



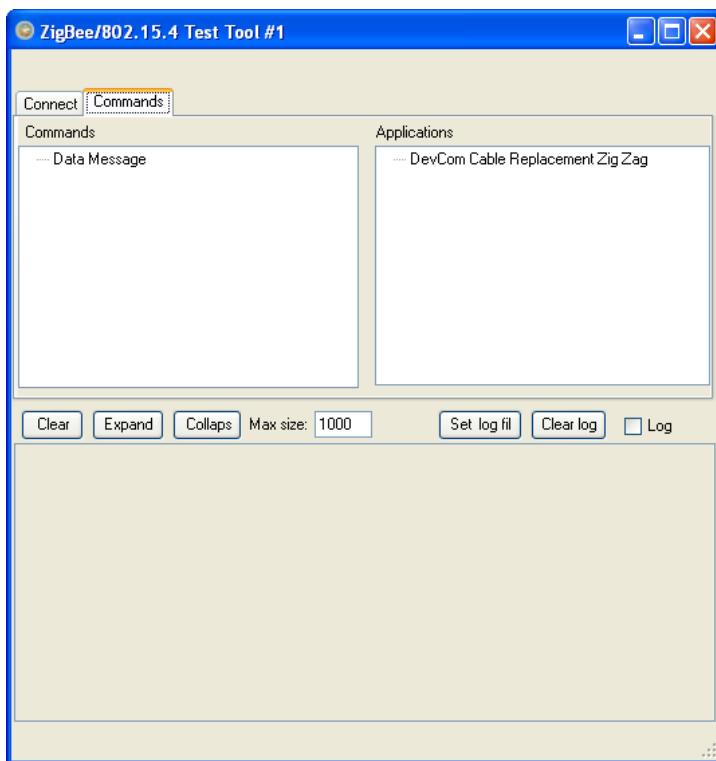
Now all you have to do is follow the steps below:

1. Open the program (a shortcut will be installed automatically on your desktop)
2. Once the program is open, choose a COM port. There are two ports for each module - that is, four in all.

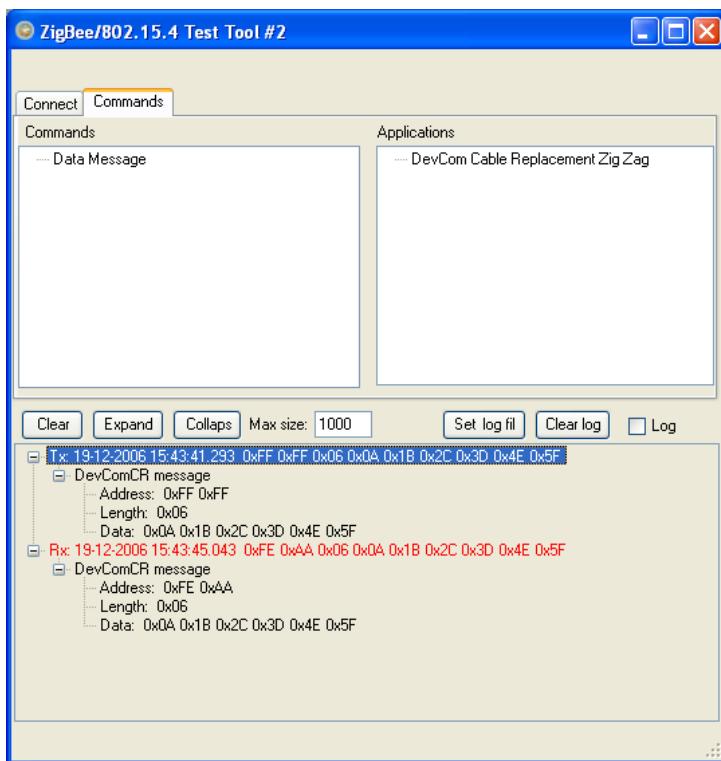
It is important to choose the first of the two ports! If you are unsure which port belongs to which socket on the ZigBee Development Board, try pulling out one of the USB cables, close down the program and restart. Now you can see which ports have disappeared. Reconnect the cable, close the program down and restart it.



3. Once you have found the right COM port, choose the protocol "DevCom Cable Replacement". Set the baud rate at 57600.
4. Now press the button "Connect" and click the tab "Commands". The port has now been connected and is ready for use.



5. Open a new instance of the program "ZigBee/802.15.4 Test Tool".
6. Select the COM port for the second position (A if B was chosen first, and B if you chose A first). Just remember: it **must** be the first of the two ports belonging to each position.
7. Repeat steps 4-6.
8. Double-click "Data Message" in one of the windows.
9. Next click the button "Send". In the lower window, you can follow the communication. Blue text means that the program is **transmitting** data, red text that the program is **receiving** data.
10. Double-click the blue or the red text to see details (for example transmitter address). This can also be done in the other window (red text), which will e.g. show you the receiver address.



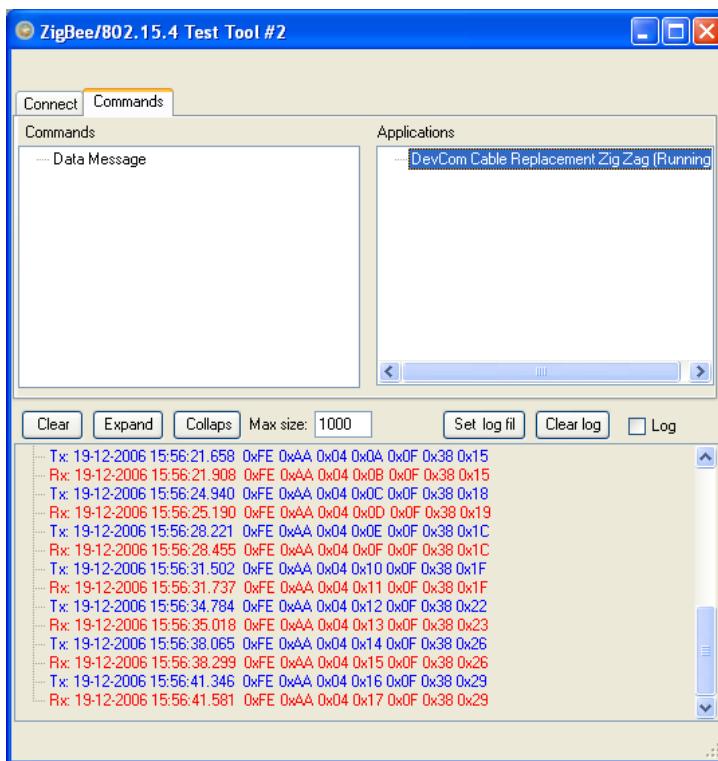
6.2 The Demo Application ZigZag

The DevCom Cable Replacement comes with a small demo application, ZigZag. The application demonstrates wireless communication between the two DevCom ZigBee Modules, allowing you to see on the screen the transmission of data back and forth.

The application is opened by double-clicking ZigZag in the right window in both instances.

Tick off "Initiate ZigZag" in one of the pop-up windows to choose which end to start transmission. Follow developments on the screen and in the display on the ZigBee Development Board. You could try and vary the time.





End the program by right-clicking "DevCom Cable Replacement ZigZag" and choose "Stop".

6.3 DevCom Cable Replacement

The DevCom modules are equipped with DevCom Cable Replacement software. With this software it is possible to transmit and receive messages between the USB port and the radio interface. The function of the pins depends on the position A or B, see Table 6.1 and Table 6.2 for pin functions:

Table 6.1 Pin functions in position A

Pin Number	Pin Name	Description
2	/RESET	BDM port
3	BKGD	BDM port
5	PTE1/RXD1	Serial port or USB A
6	PTE0/TXD1	Serial port or USB A
7	PTC1/RXD2	USB A
8	PTC0/TXD2	USB A
9	PTD4/TPM2CH1	Display
10	PTD2/TPM1CH2	Display
11	PTA0/KBI1P0	Push Buttons
12	PTA1/KBI1P1	Push Buttons
13	PTA2/KBI1P2	Push Buttons
14	PTA3/KBI1P3	Push Buttons
15	PTA4/KBI1P4	LED Indicators
16	PTA5/KBI1P5	LED Indicators
17	PTA6/KBI1P6	LED Indicators
18	PTA7/KBI1P7	LED Indicators
19	PTB0/AD1P0	Display
20	PTB1/AD1P1	Display
21	PTB2/AD1P2	Display
22	PTB3/AD1P3	Application select must be left open

Table 6.2 Pin functions in position B

Pin Number	Pin Name	Description
2	/RESET	BDM port
3	BKGD	BDM port
5	PTE1/RXD1	USB B
6	PTE0/TXD1	USB B
7	PTC1/RXD2	USB B
8	PTC0/TXD2	USB B
11	PTA0/KBI1P0	Push Button
15	PTA4/KBI1P4	LED Indicators
16	PTA5/KBI1P5	LED Indicators
17	PTA6/KBI1P6	LED Indicators
18	PTA7/KBI1P7	LED Indicators
22	PTB3/AD1P3	Application select must be left open

6.3.1 UART

The UART is an 8N1 UART with a fixed baud rate of 57600.

The protocol has the following definition:

<STX><Address><Length><Data>ETX>

STX	1 byte	02H
Address	2 bytes	Transmit: Device ID of the receiver Receive: Device ID of the transmitter
Length	1 byte	The length of the data string
Data	Up to 100 bytes	
ETX	1 byte	03H

If no ETX is received, the data received are ignored.

7 Interfaces

7.1 POWER SUPPLY

Input power is applied either by external connection to the J12 power jack or USB power, or by internal power from a 3V lithium battery. The external supply selection is controlled with a jumper (JP4, jumper ON USB power).

Important! There is no protection diode or fuse between the voltage regulators and the switch. Input voltage is regulated to either +3V0 or +3V3 (DIP switch selectable) supply by U9 and to +12V for the OLED supply by U11.

7.1.1 BATT_EXT Switch

The BATT_EXT slide switch (SW5) provides the opportunity of switching between 3V0/3V3 power from the USB or power jack to 3V0 from a lithium battery. With the switch in the BATT position, the entire board will be supplied from the 3V lithium battery¹, except the USB UARTs, which are always USB powered.

7.1.2 J12 Power Jack

J12 provides an option for external power to the board. If the USB drive on the PC is not a High Power USB, the board needs to be powered via the power jack. The J12 power jack accepts a standard 2.0 ~ 2.1mm center barrel plug connector (positive voltage center) to provide the VCC supply of +5 to +12 VDC.

7.1.3 Mains Adaptor

The ZigBee Development Board is supplied with a universal input (100-240VAC) mains adaptor, able to supply the board with 5VDC.

7.1.4 Battery connector

The battery connector accepts a CR2 lithium battery (3V).

¹ Version 1.0 - in version 2.0 all 3V-connected circuits are split into four groups, allowing them to be disconnected separately, thus enabling only ZigBee modules to be powered by battery.

7.2 USB and COM Ports

The USB and COM ports provide access to the UARTs on the development board.

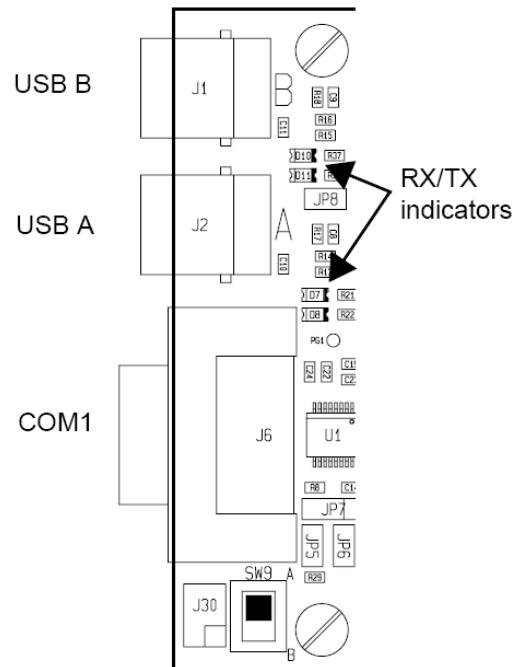


Figure 7.1 COM Ports

It is possible to use either USB A and USB B or COM1 and USB B. [Table 7.1](#) shows the different possibilities of RX/TX connections.

Table 7.1 Board connections

J#	Connects to ZigBee modules		
USB A (J2)	DevCom A (J22) RX1/TX1	7pole (J25)	12pole (J27)
USB A (J2)	DevCom A (J22) RX2/TX2	-	-
COM1 (J6)	DevCom A (J22) RX1/TX1	7pole (J25)	12pole (J27)
USB B (J1)	DevCom B (J21) RX3/TX3	7pole (J24)	12pole (J26)
USB B (J1)	DevCom B (J21) RX3/TX4	-	-

7.2.1 USB A

The USB A port provides standard 4 Pin USB-B connection. The interface provides two serial channels on the development board, both connected to the DevCom A connector J22. One of the interfaces is also connected to J25 and J27 interface connectors.

One of the channels shares the UART_TX_1 and UART_RX_1 signals with the RS232 interface. The jumper JP7 selects the target receiver source (USB or RS232). The second channel may also be disconnected from target by means of jumper JP8. With both JP7 and JP8 OFF, target receiver is connected to development connectors J16 and J32 only. The USB A port has a USB-B connector interfacing with the U6 transceiver.

7.2.2 USB B

The interface provides two serial channels on the development board, both connected to the DevCom B connector J21. One of the channels is also connected to J24 and J26 interface connectors. The USB B port has a USB-B connector that interfaces with the U6 transceiver.

7.2.3 USB-B Connector Type

The following is the USB-B (*USB-B is the connector type*) connection reference.

V_USB	1
USBDM	2
USBDP	3
Gnd	4

A driver for the FTDI chip can be downloaded from here: <http://www.ftdichip.com/Drivers/FT232-FT245Drivers.htm>

7.2.4 COM1

The COM1 port features a female DB9 connector with RS232 type interface that interfaces with the U1 RS232 transceiver. It applies simple 2-wire asynchronous serial without flow control. The UART_TX_1 and UART_RX_1 signals are converted to/from RS232 levels by U1 and provided to the COM1 connector.

The following is the DB9S connection reference:

NC	1		
Tx1	2	6	4
Rx1	3	7	NC
	6	4	NC
Gnd	5	9	NC

7.3 Push Buttons

The SW1 – SW4 push buttons provide momentary active low input for user applications. The switches provide input to DevCom A ports PTA0 - PTA3. The button does not have pull up or pull down.

The SW10 push button provides momentary active low input for user applications. The switch provides input to DevCom B port PTA0. The button does not have pull up or pull down.

7.4 LED Indicators

The LED1 – LED8 provide simple output indication for user applications. LED1 – LED4 are connected to DevCom A ports PTA4 - PTA7 (PTD0 - PTD2). The LEDs are sourced by a quad buffer (U10), which may be disabled by dipswitch SW8 pin 8.

LED5 – LED8 are connected directly to DevCom B ports PTA4 - PTA7 (PTD0 - PTD2).

7.5 RESET Buttons

The two RESET buttons provide a manual option to reset the DevCom boards. SW7 resets the "A" target, SW6 the "B" target.

7.6 Prototype Area

The prototype area provides a convenient and fast interconnection for prototyping circuits on the ZigBee Development Board. Users may apply a jumper cable or just a single solid wire from J13 to make connections between the I/O port connectors and the prototype area. Soldering is required. It is possible to remove the prototype area from the development board by breaking the PCB where the v-cut is. If broken, the battery option is removed as well. Parts of the prototype area are connected for easy distribution of power. Please see Figure 7.2.

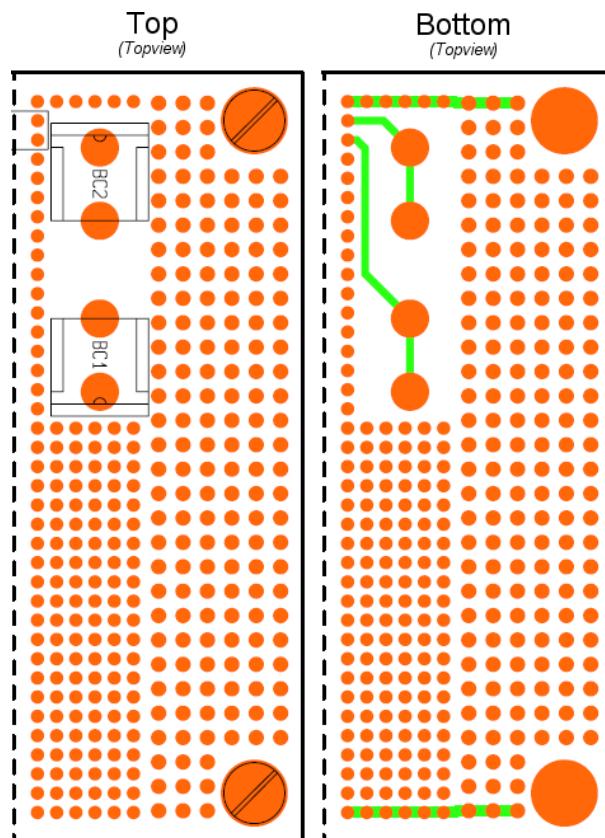


Figure 7.2 Prototype area

8 Connectors and Selection Switches

8.1 DevCom ZigBee Modules

It is possible to make the following combinations of DevCom ZigBee Modules on the development board at the same time:

- 2 DevCom
- 1 DevCom + 1 "7pole"
- 1 DevCom + 1 "12pole"
- 1 "7pole" + 1 "12pole"

IMPORTANT!

If a DevCom ZigBee Module is connected to the development board, no other ZigBee module can be connected to the board in that area (A or B), due to interference on the UART.

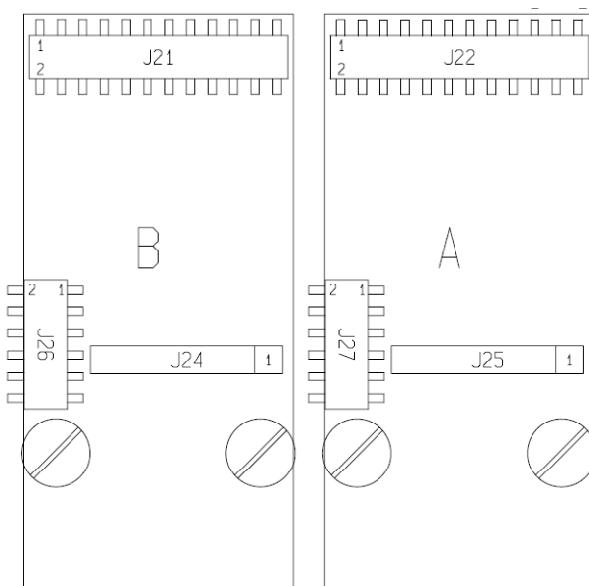


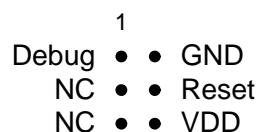
Figure 8.1 Board connections

Table 8.1 Board connections

J#	Module
J22	DevCom A
J25	"7pole" A
J27	"12pole" A
J21	DevCom B
J24	"7pole" B
J26	"12pole" B

8.2 BDM Ports

The BDM port is a 6 pin header compatible with a Background Debug Mode (BDM) Pod. This allows connection of a background debugger for software development, programming and debugging in real-time.

**Figure 1**

There is one BDM port on the development board. The port is routed to either area A or area B connectors by means of selection switch SW9.

Table 8.2 BDM target selection

SW9	BDM Connections to ZigBee modules		
A	DevCom A (J22)	"7pole" (J25)	"12pole" (J27)
B	DevCom B (J21)	"7pole" (J24)	"12pole" (J26)

8.2.1 BDM Pod

BDM pods suitable include, for example, the **USB HCS08/HCS12 Multilink** and the **CyclonePRO**, both available from **P & E Microcomputer Systems** (<http://www.pemicro.com/>)



8.3 Jumper Connections

The jumpers on the development board are 2 or 3 pin jumpers. For the standard operation of the jumpers, look for the ON in the description in [Table 8.3](#).

Table 8.3 Jumper connections

JP#	Pin 1	Pin 2	Pin 3	Description
JP5	3V	Section B power	-	3V: 3V directly to section B (ON) OFF: Enables current measurement as the voltage across JP5 divided by 4.7 ² .
JP6	3V	Section A power	-	3V: 3V directly to section A (ON) OFF: Enables current measurement as the voltage across JP5 divided by 4.7 ³ .
JP4	V_USB	IN (U9)	VDC	V_USB: USB power supply (ON) VDC: Power jack supply
JP7	U5 TXD1	UART_RX_1	U1 RXD	U5 TXD1: Target A serial Ch.1 comm. Via USB A (ON) U1 RXD: Target A serial Ch.1 comm. via RS232 OFF: Target A serial Ch.1 comm. via J13 & J16
JP8	U5 TXD2	UART_RX_2	-	U5 TXD: Target A serial Ch.2 comm. via USB A (ON) OFF: Target A serial Ch.2 comm. via J13 & J16

² (Not to be used in conjunction with a connected programmer on the BDM connector).

³ Do.

8.4 Configuration DIP-Switch

The development board features an 8-pole configuration DIP-switch to facilitate easy setup of the development board.

Table 8.4 DIP switch setting

SW8	ON	OFF	Explanation
1	3V0 = ON	3V0 = OFF	Power to ZigBee modules and auxiliary connectors (J21, J24, J26, J22, J25, J27 & J13, J14)
2	3V = ON	3V = OFF	Power to LED-driver, BDM and auxiliary connectors (J13, J14)
3	3V_USB = ON	3V_USB = OFF	Power to USB transceivers, RS232 transceiver and auxiliary connectors (J13, J14)
4	3V_OLED = ON	3V_OLED = OFF	3V to display and auxiliary connectors (J13, J14)
5	12V OLED power = ON	12V OLED power = OFF	12V to display
6	3V supplies = 3V	3V supplies = 3.3V	Overall 3V value selection: 3V or 3.3V
7	RS232 receiver output = ON	RS232 receiver output = High Z	RS232 reception enable/disable
8	LED driver = ON	LED driver = OFF	LED enable/disable

8.5 Single-row pin connectors

The single-row pin connectors J16 and J13 just beside the switches and LEDs are connected to all the I/Os from the ZigBee modules.

Table 8.5 Pin connections

J16		
Pin#	Name	Connect to
1	RESET_2	SW6/BDM
2	DEBUG_2	BDM
3	UART_RX_1	NC
4	UART_TX_1	NC
5	UART_RX_2	NC
6	UART_TX_2	NC
7	SCL	OLED
8	SDA	OLED
9	KBIP0	SW1
10	KBIP1	SW2
11	KBIP2	SW3
12	KBIP3	SW4
13	KBIP4	LED1 (D3)
14	KBIP5	LED2 (D4)
15	KBIP6	LED3 (D5)

J16		
Pin#	Name	Connect to
16	KBIP7	LED4 (D6)
17	AD0	OLED
18	AD1	OLED
19	AD2	OLED
20	AD3	NC
21		3V0
22		3V
23		VDC
24		V_USB
25		12V_OLED
26		GND
27	2KBIP4	LED5 (D14)
28	2KBIP5	LED6 (D15)
29	2KBIP6	LED7 (D16)
30	2KBIP7	LED8 (D17)

J16 is connected directly to J13, which is used to connect to the prototype area.

9 OLED Display

The OLED display on the development board is only connected to the DevCom A connector, and cannot be controlled by any of the other ZigBee modules. It is possible to connect to the OLED display from the prototype area. Please see the connection diagram Table 9.1.

Table 9.1 OLED connections

PIN#	Development board	OLED	Description
1	AD0	CS#	Chip select
2	AD1	RES#	Reset
3	GND	BS1 (C86)	Set to Low or connect to VSS; JP2 on flex is set to 0
4	AD2	D/C#	High: Data in GDRAM Low: Command
5	NC	NC	Not connect
6	NC	NC	Not connect
7	SCL_PWM2CH0	SLK	Serial Clock Input
8	SDA_PWM2CH1	SDIN	Serial Data Input
9	NC	NC	Not connect
10	NC	NC	Not connect
11	NC	NC	Not connect
12	NC	NC	Not connect
13	NC	NC	Not connect
14	NC	NC	Not connect
15	NC	NC	Not connect
16	3V	VDD	Logic Power
17	12V	VCC (VLL)	OLED Drive Power
18	GND	VSS	Ground

9.1 Driver

The driver for the OLED display will support the option of showing pictures and writing text.

```
write_string(char *, int, unsigned char, unsigned char, unsigned char, unsigned char);
    Writes an ASCII text string, and places it anywhere on the screen.
    Just give the coordinates where you want it to be placed. The coordinates should be
    given in this order: Line start, Line end, Column start and Column end.
    If text is only allowed on one line, then Line end should be Line start plus one.

write_pic(unsigned char *, unsigned char, unsigned char, unsigned char, unsigned char);
    Writes any picture in 4-bit hex, and places it anywhere on the screen.
    Just give the coordinates where you want it to be placed. The coordinates should be
    given in this order: Column start, Column end, Row start and Row end.

init_OLED(void);
    Initializes the display, and erases the display ram.

reset_OLED(void);
    Resets the display ram.

run_Dovelco(void);
    Writes the Dovelco logo on the display.

toggle_OLED(void);
    Toggles the grayscale of the display pixels.
    E.g.: G0 (dark) becomes G15 (bright)

flip_OLED(void);
    Toggles the display coordinates.
    E.g.: coordinate 0.0 becomes 95.63 and coordinate 95.63 becomes 0.0.

screen_saver(void);
    Scrolls the display pixels by moving the offset one pixel at a time.

write_button(unsigned char);
    Makes a 3D button on the screen.
    Just give the start line for the button. The button is 15x128 pixel (entire screen width).
    It is possible to write one text line in the button.
```

10 Troubleshooting

The ZigBee Development Board is fully tested and operational before shipping. If it fails to function properly, first inspect the board for obvious physical damage. Verify the communications setup as described under [Getting Started](#).

The most common problems are improperly configured jumpers, and attempting to use the wrong COM port.

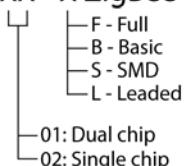
1. Verify that your communication port is working by substituting a known good serial device or by doing a loop back diagnostic.
2. Verify the power source. You should measure following minimum voltages on the power section of the J16 connector:
 - Between the GND and V_USB: +4.7 volts.
 - Between the GND and 3V0: +3 volts.
 - Between the GND and VDC: +5 volts.
3. If no voltage is found, verify the wall plug connections to 230VAC outlet and the power connector.
4. Verify the logic power source. You should measure +3 volts or +3.3 volts between the GND and 3V connections on the J16 connector. If the power source is good and this supply is not +3V0 or +3V3, immediately disconnect power from the board. Contact devcom@develco.com by email for instructions, and state board name and a description of the problem.
5. Verify the jumper settings (please see **Fejl! Henvisningskilde ikke fundet.** page **Fejl! Bogmærke er ikke defineret.**).
6. Disconnect all external connections to the board except for COM1 to the PC and the wall plug.
7. Make sure the RESET line is not held low and the RESET indicator (therefore) lit.
8. Contact devcom@develco.com by email for further assistance. Please state board name and describe the problem.

11 Ordering Information

The DevCom series includes the following products:

Product name	Order number	Develco item number
DevCom 01-F ZigBee Module	DevCom01-F	F0002Z0000
DevCom 01-B ZigBee Module	DevCom01-B	F0013Z0000
DevCom 02-L ZigBee Module	DevCom02-L	F0003Z0000
DevCom 02-S ZigBee Module	DevCom02-S	F0004Z0000
DevKit	DevKit	F0011Z0000

DevCom XX - X ZigBee Module



11.1 Downloads

By purchasing Develco's ZigBee Development Board, you are able to download the technical documentation from Develco's website www.develco.com. Here you can find the newest version of the documents concerning the DevCom 01 & 02 ZigBee Module as well as the ZigBee Development Board. You can also download the ZigBee 802.15.4 Test Tool and drivers.

To access the above mentioned, you have to be registered DevCom user.

Registered membership is free and is easily done. Just send an e-mail to devcom@develco.com mentioning your name, address, phone number, company and e-mail. You will subsequently receive an e-mail confirming your registration and password.

All information will be dealt with in strict confidence. You will solely receive the above mentioned e-mail, and your e-mail will not be subjected to shipment of any other information.

12 Contact Information

Technical support: Please contact one of your local EBV offices <http://www.ebv.com>. You can also send us an e-mail develco@ebv.com.

Sales: Please contact one of your local EBV offices <http://www.ebv.com>. You can also send us an e-mail develco@ebv.com.

DevCom Registration: Please contact Develco:

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Fax. +45 87 400 333
devcom@develco.com
<http://www.develco.com>

13 About Develco A/S

Develco is an independent design house. It was founded in 1989, and most of our staff has an engineering background.

Develco's core competencies are in electronic engineering and embedded software. As we work in close partnerships an extensive and highly competent network, we are able to handle very comprehensive projects. Our customers are primarily industrial operators who have their own product line. We provide complete solutions that turn our customers into leaders in their field.

Develco transfers knowledge across business lines. We work in several lines of business - Wireless, Automotive & Industrial. The synergy achieved by working with diverse companies in a broad spectrum of businesses benefits all of our customers

Technological development is an area of high priority in Develco. We continuously strive to introduce new technologies and improve quality, doing our utmost to keep our customers on the leading edge.

Develco is a member of the ZigBee Alliance and is also a Freescale Alliance Partner. We have been developing ZigBee enabled products since January 2004, e.g. for home control, security and AMR systems, the first of which have already been brought into production.

Develco is ISO14001:2004 and ISO9001:2000 certified.



QUALITY SYSTEM
DS/EN
ISO 9001

